VAISALA

USER'S GUIDE

Vaisala DRYCAP®
Dewpoint Transmitter DMT143

M211435EN-D

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Table of Contents

CHAPTER 1
GENERAL INFORMATION **5**
About This Manual **5**
Contents of This Manual 5
Version Information 6
Related Manuals 6
Documentation Conventions 6
Safety **7**
ESD Protection 7
Recycling **7**
Regulatory Compliances **8**
Trademarks **8**
License Agreement **8**
Warranty **8**

CHAPTER 2
PRODUCT OVERVIEW **9**
Introduction to DMT143 ..... **9**
Basic Features and Options **10**
Transmitter Parts **11**
Model with G1/2" ISO228/1 Thread 11
Model with NPT Thread 12
Loop-Powered Display **13**
Connection Cables **14**
Sampling Accessories **14**

CHAPTER 3
FUNCTIONAL DESCRIPTION **15**
DRYCAP® Technology **15**
Auto-Calibration 15
Sensor Purge 15
Sensor Warming in High Humidities 16
DMT143 Startup Sequence **17**
Alarm LED **18**

CHAPTER 4
INSTALLATION **19**
Transmitter Configuration Before Installation **19**
Selecting the Location **20**
Installing the Transmitter **20**
Wiring **22**
Power Supply Requirements 23
Sampling from a Process **26**

Sampling Accessories 26
DMT242SC Sampling Cell 26
DMT242SC2 Sampling Cell with Swagelok Connectors 26
DSC74 Sampling Cell with Quick Connector and Leak Screw 27
DSC74B Two-Pressure Sampling Cell 28
DSC74C Two-Pressure Sampling Cell with Coil 30
DM240FA Duct Installation Flange 32

CHAPTER 5
OPERATION 33
Transmitter Start-Up 33
Operation with DM70 Hand-Held Dewpoint Meter 34
Serial Communication 35
Connecting to the Serial Interface 35
Installing the Driver for the USB Service Cable 35
Terminal Application Settings 36
List of Serial Commands 38
Device Information 39
Show Device Information 39
Show Analog Output Mode 39
Show Firmware Version 40
Show Firmware Information 40
Show Currently Active Errors 40
Show Serial Number 40
Show Command List 41
Configuring Analog Output 42
Set Analog Output Parameters and Scaling 42
Set Analog Output Error Notification 43
Extend Analog Output Range 44
Test Analog Output 44
Enable or Disable Analog Output 45
Serial Line Output Commands 45
Start Measurement Output 45
Stop Measurement Output 45
Set Output Interval 46
Output a Reading Once 46
Configuring Measurement Parameters 47
Set Measurement Output Format 47
Set Measured Gas Type 49
Set Measurement Filtering 49
Set Pressure Compensation Value 50
Select Unit 51
View User Adjustment Parameters 51
Set User Adjustment Parameters 52
Configuring Serial Line Operation 53
Set Serial Line Operating Mode 53
Set Serial Line Settings 54
Set Transmitter Address 54
Set Serial Line Response Time 55
Other Commands 55
Opening the Transmitter in POLL Mode 55
Closing the Connection to a Transmitter in POLL Mode 55
Configure the Alarm LED 56
Show Transmitter Uptime 57

Reset Transmitter 57
Restore Factory Settings 57

CHAPTER 6
MAINTENANCE 59
Periodic Maintenance 59
Cleaning 59
Calibration 59
Changing the Filter 60
Field Check Using the DM70 Hand-Held Dewpoint Meter .. 61
Repair Maintenance 62

CHAPTER 7
TROUBLESHOOTING 63
Solving Typical Problems 63
Error Messages 64
Unknown Serial Settings 64
Technical Support 65
Product Returns 65

CHAPTER 8
TECHNICAL DATA 67
Specifications 67
Spare Parts and Accessories 70
Dimensions in mm 71

List of Figures

Figure 1 DMT143 Parts – Model with ISO Thread 11
Figure 2 DMT143 Parts – Model with NPT Thread 12
Figure 3 Nokeval 301 Loop-Powered Display 13
Figure 4 DMT143 Startup Sequence 17
Figure 5 Removing the Transport Protection Cap 20
Figure 6 Installing the Transmitter with Sealing Ring 21
Figure 7 Tightening with a Wrench 21
Figure 8 DMT143 Digital and Analog Connectors 22
Figure 9 Wiring the Digital Connector 22
Figure 10 Wiring the Analog Connector 22
Figure 11 Example of Current Consumption During Purge 24
Figure 12 Example of Current Consumption During Auto-Calibration 25
Figure 13 Sampling Cells DMT242SC2 (left) and DMT242SC (right) 27
Figure 14 DSC74 Sampling Cell with Accessories 28
Figure 15 DSC74B 29
Figure 16 Removing the Leak Screw 29
Figure 17 Default Assembly of DSC74C 30
Figure 18 Alternative Assembly of DSC74C (for Tight Spaces) 31
Figure 19 DM240FA with DMT143 32
Figure 20 Measurement Settings Menu 34
Figure 21 PuTTY Terminal Application 37
Figure 22 Removing the Filter 60
Figure 23 Comparing Dewpoint Readings on MI70 62
Figure 24 Dewpoint Accuracy vs. Measurement Conditions 68
Figure 25 DMT143 Dimensions – Model With ISO Thread 71
Figure 26 DMT143 Dimensions – Model With NPT Thread 71

List of Tables

Table 1 Manual Revisions 6
Table 2 Related Manuals 6
Table 3 Output Parameters of the DMT143 9
Table 4 Alarm LED States 18
Table 5 Connector Pinouts 22
Table 6 Default Serial Interface Settings 36
Table 7 List of Serial Commands 38
Table 8 FORM Command Parameters 48
Table 9 FORM Command Modifiers 48
Table 10 Pressure Conversion Coefficients 50
Table 11 Selection of Output Modes 53
Table 12 Troubleshooting Table 63
Table 13 Error Messages 64
Table 14 Measured Parameters 67
Table 15 Operating Environment 68
Table 16 Outputs 68
Table 17 General 69
Table 18 Spare Parts and Accessories for DMT143 70

CHAPTER 1

GENERAL INFORMATION

This chapter provides general notes for the manual and the DMT143.

About This Manual

This manual provides information for installing, operating, and maintaining DMT143.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and the DMT143.
- Chapter 2, Product Overview, introduces the DMT143 transmitter and its features.
- Chapter 3, Functional Description, describes the advanced functionality of DMT143, including the auto-calibration, sensor purge, and sensor warming functions.
- Chapter 4, Installation, provides you with information that is intended to help you install the DMT143.
- Chapter 5, Operation, contains information that is needed to operate the DMT143.
- Chapter 6, Maintenance, provides information that is needed in basic maintenance of the DMT143.
- Chapter 7, Troubleshooting, describes common problems, their probable causes and remedies, and provides contact information for technical support.
- Chapter 8, Technical Data, provides the technical data of the DMT143.

Version Information

Table 1 Manual Revisions

Manual Code	Description
M211435EN-D	June 2013. This manual. Updated wiring instructions.
M211435EN-C	January 2013. Previous version. Updated command descriptions for ASEL, FORM, SERI, and SDELAY commands.
M211435EN-B	June 2012. Updated section Alarm LED on page 18. Updated section Configure the Alarm LED on page 56. Updated technical specification and dimension drawings.
M211435EN-A	First version.

Related Manuals

Table 2 Related Manuals

Manual Code	Manual Name
M211434EN	DMT143 Quick Guide
M211634EN	Nokeval 301/302 Display Wiring Diagram

Documentation Conventions

Throughout the manual, important safety considerations are highlighted as follows:

WARNING	Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

CAUTION	Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

NOTE	Note highlights important information on using the product.

Safety

The DMT143 delivered to you has been tested and approved as shipped from the factory. Note the following precautions:

CAUTION	Do not modify the unit. Improper modification can damage the product or lead to malfunction.

CAUTION	The transmitter body does not have user serviceable parts inside, and is not designed to be opened. Opening the transmitter will void the warranty.

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. It is possible to damage the product, however, by delivering electrostatic discharges when touching the exposed connectors on the back of the product.

To make sure you are not delivering high static voltages yourself, avoid touching the exposed pins of the connectors.

Recycling

Recycle all applicable material.

Dispose of the unit according to statutory regulations. Do not dispose of with regular household refuse.

Regulatory Compliances

DMT143 is in conformity with the provisions of the following EU directives:

- EMC-Directive
- RoHS-Directive

Conformity is shown by compliance with the following standards:

- EN 61326-1: Electrical equipment for measurement, control, and laboratory use – EMC requirements – for use in industrial locations.
- EN 550022: Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement.

CE N17728

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Warranty

Visit our Internet pages for standard warranty terms and conditions: www.vaisala.com/warranty.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

CHAPTER 2

PRODUCT OVERVIEW

This chapter introduces the DMT143 transmitter and its features.

Introduction to DMT143

Vaisala DRYCAP® Dewpoint Transmitter DMT143 is a small and lightweight dewpoint transmitter suitable for a wide range of OEM applications. The DMT143 is easy to install and the mechanics have been designed for harsh environments requiring protection against dust, dirt and splashed water.

DMT143 uses a DRYCAP® polymer sensor for dewpoint measurement. DRYCAP® technology has low maintenance needs due to its excellent long term stability and durability against condensation. The calibration interval of the DMT143 is two years.

Table 3 Output Parameters of the DMT143

Parameter	Abbreviation	Metric Unit	Non-Metric Unit
Dewpoint/frost point temperature	Tdf	ºC	ºF
Dewpoint/frost point temperature, converted to atmospheric pressure	Tdfatm	ºC	ºF
ppm moisture, by volume	H20	ppm	ppm

NOTE When dewpoint is below 0 °C, the transmitter outputs frostpoint for Td.

Dewpoint temperature in atmospheric pressure ($T_{d/f}$ atm) is a calculated parameter that presents the dewpoint the gas would have at atmospheric pressure. For this calculation to provide accurate results, it is important to have the correct pressure setting stored in the transmitter. This setting is specified on the order form, and it can be changed using the RS-485 line or DM70 hand-held dewpoint meter.

Basic Features and Options

- Dewpoint measurement range -60 ... +60 °C (-76 ... +140 °F).
- Dewpoint measurement accuracy up to ±2 °C (±5.4 °F) T_d in air or N_2.
- Operating pressure range 0 ... 50 bar_a (725 psia).
- Configurable for optimum dewpoint measurement accuracy:
  - Dewpoint measurement in SF_6 or air.
  - Pressure compensation (fixed pressure setting or live pressure input through RS-485).
- Analog output: one output channel, selectable from:
  - 0 ... 1 V
  - 0 ... 5 V
  - 1 ... 5 V
  - 4 ... 20 mA
- Digital output: RS-485 (non-isolated).
- LED for dewpoint level alarm and transmitter diagnostics.
- DRYCAP® polymer sensor:
  - Autocalibration ensures accuracy in changing measurement conditions.
  - Sensor warming keeps the sensor dry in high humidity.
  - Sensor purge ensures long term stability.
- NIST traceable (certificate included).
- Field check suitability with DM70 hand-held dewpoint meter.
- Optional accessories:
  - Stainless steel grid filter for vacuum applications.
  - Sampling cells with various installation options.
  - Loop-powered external display.
  - Connection cable for DM70 hand-held dewpoint meter.
  - Plastic shipping case for avoiding contamination during shipping.

Transmitter Parts

NOTE	When the transmitter is delivered, the filter is protected by a yellow transport protection cap that keeps the sensor dry. The transport protection cap should be left on the transmitter during storage. Remove the transport protection cap before installing the transmitter.

Model with G1/2” ISO228/1 Thread

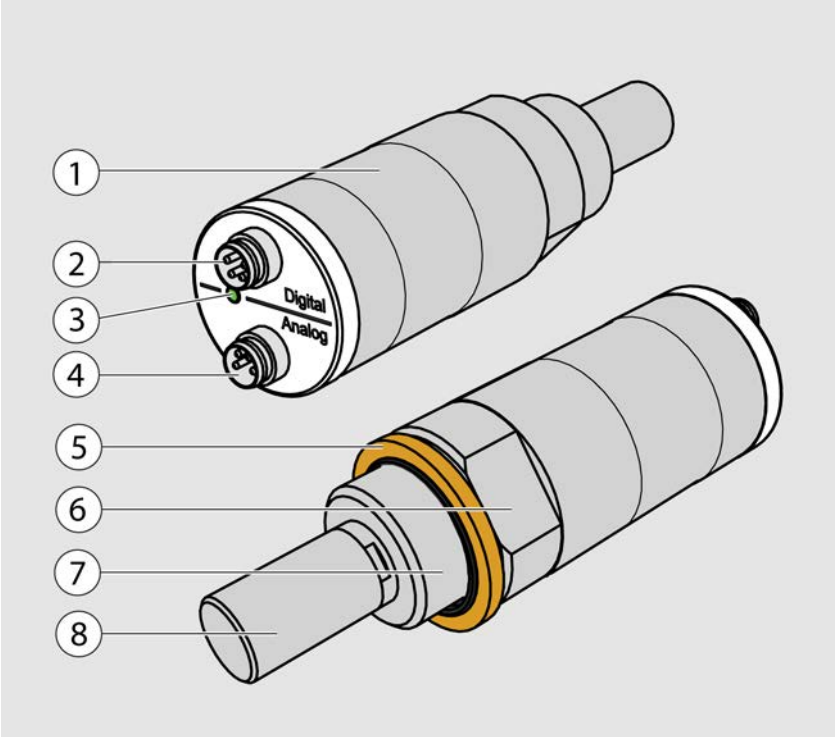

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Figure 1 DMT143 Parts – Model with ISO Thread

The following numbers refer to Figure 1 above:

1 = Transmitter body. Type label is applied here.
2 = Digital output: non-isolated RS-485.
3 = Alarm LED.
4 = Analog output.
5 = Sealing ring.
Must be used with the G1/2” ISO228/1 connection thread.
6 = 24 mm nut.
7 = Connection thread: G1/2" ISO228/1.
8 = DRYCAP® sensor protected with sintered filter.

Model with NPT Thread

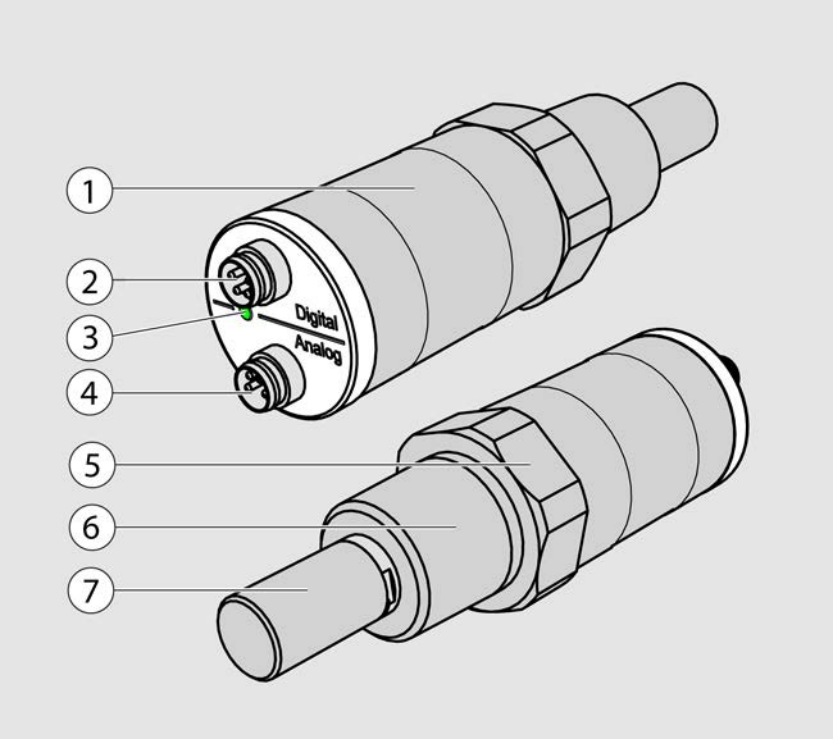

Figure 2 DMT143 Parts – Model with NPT Thread

The following numbers refer to Figure 1 on page 11:

1 = Transmitter body. Type label is applied here.
2 = Digital output: non-isolated RS-485.
3 = Alarm LED.
4 = Analog output.
5 = 30 mm nut.
6 = Connection thread: NPT 1/2".
7 = DRYCAP® sensor protected with sintered filter.

Loop-Powered Display

DMT143 can be connected to a loop-powered external LED display. The display provides a reading of the output parameter. The display is powered by the 4 ... 20 mA current signal, so there is no need for an external power supply.

Two models are available:

- Nokeval 301
- Nokeval 302 (with alarm relays)

The display is delivered at its default settings. Configure the display functions and scaling according to the documentation delivered with the display. For a wiring example, see Nokeval 301/302 Display Wiring Diagram (document code M211634EN). For the order codes of the displays, see section Spare Parts and Accessories on page 70.

1102-053

Figure 3 Nokeval 301 Loop-Powered Display

NOTE	The loop resistance of the display must be included in the loop resistance calculation for the complete current loop. For the loop resistance of the display, refer to the manufacturer's documentation.

Connection Cables

Vaisala supplies shielded cables with M8 female straight threaded connector. Standard cables are available in four lengths:

- 0.3 m (1.0 ft)
- 3 m (9.8 ft)
- 5 m (16.4 ft)
- 10 m (32.8 ft)

Heavy duty cables are available in two lengths:

- 1.5 m (4.9 ft)
- 3 m (9.8 ft)

Also available are the following cables for service and field check use:

- USB service cable
- MI70 connection cable

For the order codes of the cables, see section Spare Parts and Accessories on page 70.

Sampling Accessories

DMT143 is compatible with various sampling accessories. For more information on performing sampling, and a description of the accessories, see section Sampling Accessories on page 26.

For the order codes of the sampling accessories, refer to section Spare Parts and Accessories on page 70.

CHAPTER 3

FUNCTIONAL DESCRIPTION

This chapter describes the advanced functionality of DMT143, including the auto-calibration, sensor purge, and sensor warming functions.

DRYCAP® Technology

Vaisala DRYCAP® dewpoint measurement technology ensures accurate measurement with excellent long term stability. This results in very low maintenance requirements for the transmitter. The lasting performance is achieved with microprocessor technology and software that automatically performs self-diagnostic functions in addition to the normal dewpoint measurement. The self-diagnostic procedures that are conducted are called auto-calibration, sensor purge, and sensor warming.

Auto-Calibration

The auto-calibration feature of the DMT143 transmitter is an automatic procedure which greatly reduces the possible drift in the dry end of the dewpoint measurement. It is performed at one hour intervals, and when the power is switched on. During auto-calibration the sensor is warmed for a short period (< 1 min) and the sensor capacitance values are evaluated at the elevated temperature. The possible dry end drift is then corrected to correspond to the calibrated values. During the auto-calibration the transmitter outputs the T_d value prior to the procedure.

Auto-calibration is carried out only if several criteria for the measurement environment are fulfilled. This ensures the reliability of the adjustments, and maintains the excellent long term stability that the patented technology offers. These criteria include for example a stable enough moisture level in the measured atmosphere. If the conditions are not fulfilled, the auto-calibration function is postponed until satisfactory conditions are reached.

Sensor Purge

Sensor purge is also an automatic procedure that minimizes the drift at the wet end readings of the dewpoint measurement. Sensor purge is performed once a day or when the power is switched on. The sensor is heated for several minutes which will then evaporate all excess

molecules out of the sensor polymer. This, together with the auto-calibration results in a very small drift of the sensor due to the very linear behaviour of the polymer technology. During the sensor purge the transmitter outputs the T_d value prior to the procedure.

Sensor Warming in High Humidities

DMT143 has a warming feature which maintains the sensor temperature above 0 °C, and prevents the sensor and filter from becoming wet in high humidities. High humidity may be present when the dewpoint temperature rises close to the gas temperature.

Sensor warming is switched on automatically when the humidity in the measured gas increases to a level where dew can start to form. The advantage of sensor warming is the rapid response of dewpoint measurement. A wet sensor and filter would otherwise result in a dewpoint equal to ambient temperature (that is RH = 100 %).

If in spite of sensor warming the sensor gets soaked, it will recover fully back to normal operation after it dries out.

DMT143 Startup Sequence

When the transmitter is powered up, it will perform the sequence shown in Figure 4 below. After a two-second startup, the transmitter will measure normally for five minutes, after which it will perform the sensor purge and auto-calibration functions. This can take up to six minutes, during which time the output is frozen: it will display the last measured values before the sensor purge began.

The auto-calibration function may be postponed if the measurement environment is not suitable. For example, the environment may be changing rapidly or have too high humidity.

Normal operation and output is typically achieved no later than 11 minutes after startup. The sensor purge will repeat every 24 hours, and auto-calibration every hour. The output will again be frozen for their duration.

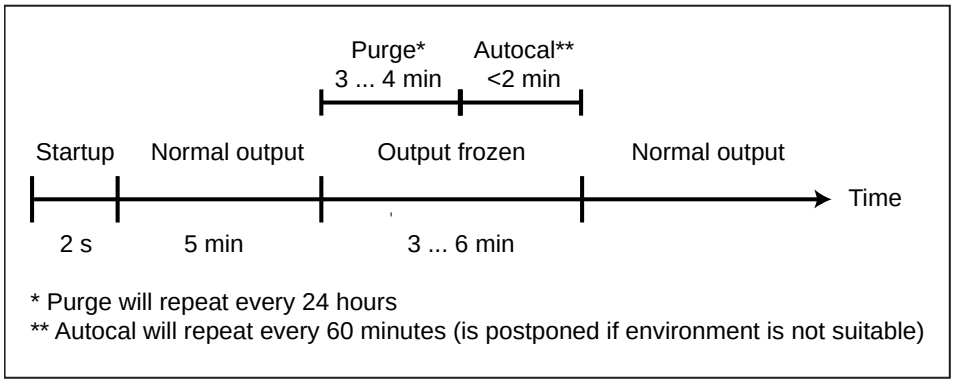

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Figure 4 DMT143 Startup Sequence

NOTE	The transmitter always performs this sequence when starting up. Keep the transmitter continuously powered to optimize its measurement performance and availability.

Alarm LED

The alarm LED at the back of the transmitter provides a visual indication of the transmitter's status. The alarm LED functionality is preset at the factory according to order form. You can configure it as follows:

- You can change the alarm limit using the DM70 hand-held dewpoint meter. See section Operation with DM70 Hand-Held on page 34.
- You can use the **ALARM** command on the serial line to change the alarm limit, enable/disable the dewpoint alarm, or turn on/off the LED completely. See section Configure the Alarm LED on page 56.

Table 4 Alarm LED States

LED Color	Meaning
Not lit	Power off or LED functionality disabled.
Green	Power on, normal measurement.
Green and blinking	Purge or autocalibration in progress, measurement frozen.
Red	Dewpoint above limit.
Red and blinking	Transmitter error. See section Error Messages on page 64.

CHAPTER 4

INSTALLATION

This chapter provides you with information that is intended to help you install the DMT143.

Transmitter Configuration Before Installation

You may wish to configure your transmitter before physically installing it. For easy access to the serial line, use the USB service cable and a terminal program on a PC. Instructions for using the serial line and the serial commands are provided in Chapter 5, Operation, on page 33.

Some configuration settings can also be changed using the D70 hand-held indicator. See section Operation with DM70 Hand-Held on page 34.

Examples of configurable settings for analog output:

1. Analog output parameter and scaling.
2. Analog output error level.

Examples of configurable settings for RS-485 output:

1. By default, DMT143 transmitters are configured for single transmitter operation. Serial operation mode is **STOP** and address is **0**.

   To configure transmitters for operation on a common line, you must give each transmitter a unique address (range 0 ... 255) and set their serial operation mode to POLL.
2. The default serial line settings may not be right for your RS-485 line.
3. You may need to change the transmitter's serial output format to suit your needs.

Selecting the Location

It is important that the point of installation represents well the gas to be measured. Temperature changes do not affect the dewpoint measurement, but pressure changes will have an effect on the measurement. All leaks in the system must be eliminated to avoid ambient humidity affecting the measurement.

Direct installation to the measured gas is the recommended installation method if the temperature of the gas is suitable for DMT143 and no additional filtering is needed due to very dusty or oily gas. Oil as such is not harmful for the DRYCAP® sensor, but response time may be slower if there are oil particles in the system, or if oil is collected to the filter over a longer period of time. The maximum measurement pressure is 50 bar_a / 725 psi_a (absolute pressure) for direct measurement.

If the gas temperature is higher than the specified maximum operating temperature of the transmitter, gas sampling and cooling it to ambient temperature (for example, 20 °C / 68 °F) is recommended. Note that the dewpoint temperature must be clearly lower than the ambient temperature to avoid condensation in the sampling line. Sampling from the process is easy by using Vaisala sampling cell options; see section Sampling Accessories on page 26.

The DMT143 is light in weight, which means that it can be installed in a sample pipeline in the sampling cells without the need of any additional mechanical support. You can use a standard G1/2" T-shaped pipe fitting (not available from Vaisala) when installing DMT143 into a pipeline.

Installing the Transmitter

1. Remove the yellow transport protection cap from the transmitter.

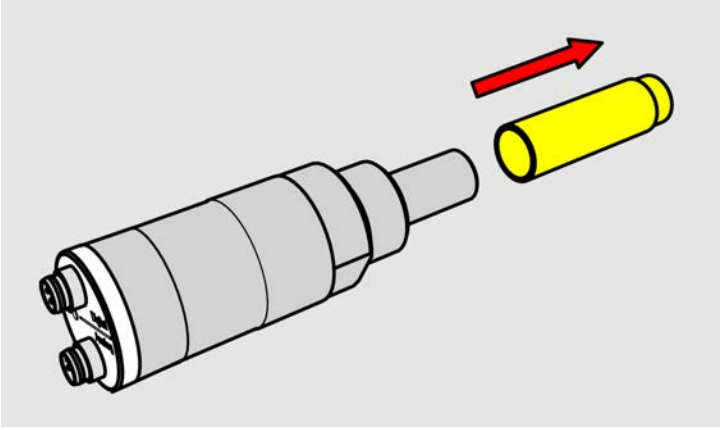

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Figure 5 Removing the Transport Protection Cap

2. Model with parallel thread (G1/2" ISO 228/1) requires a sealing ring for a tight connection. Use the sealing ring that is provided with the transmitter. Make sure the threads on the mounting point match your transmitter.

   For the model with NPT thread, do not use a sealing ring.

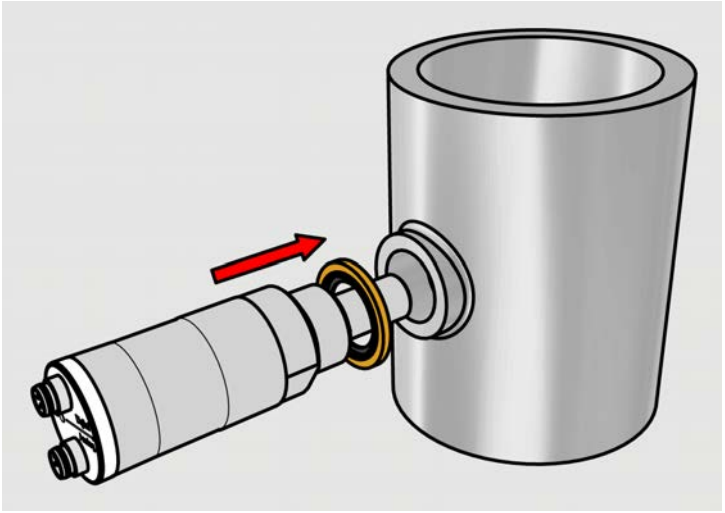

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Figure 6 Installing the Transmitter with Sealing Ring

3. Tighten the connection by turning with a wrench (max. 50 Nm). Wrench size is 24 mm for ISO threaded transmitter, 30 mm for NPT threaded model.

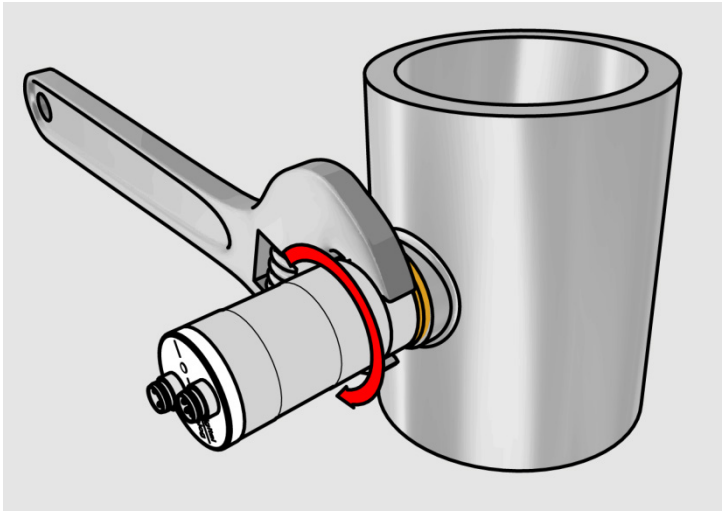

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Figure 7 Tightening with a Wrench

4. Connect the signal and power cable to the DMT143. Refer to the following sections for wiring instructions and power supply requirements.

Wiring

CAUTION The power supply lines are internally connected. You can use either one of them, but do not connect more than one supply voltage in permanent installations. Temporary simultaneous use with the USB service cable or DM70 hand-held dewpoint meter (which also provide power) is OK.

Table 5 Connector Pinouts

Pin	Analog connector	Digital connector	Wire color
1	VDC supply+	VDC supply+	Brown
2	Ch-	RS-485 D0-	White
3	GND	GND	Blue
4	Ch+	RS-485 D1+	Black

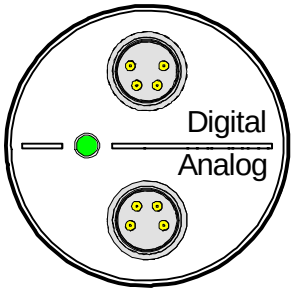


Figure 8 DMT143 Digital and Analog Connectors

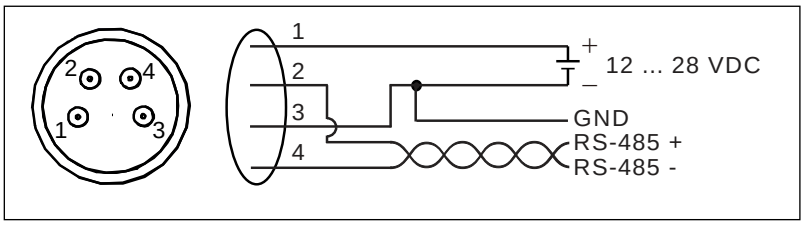


Figure 9 Wiring the Digital Connector

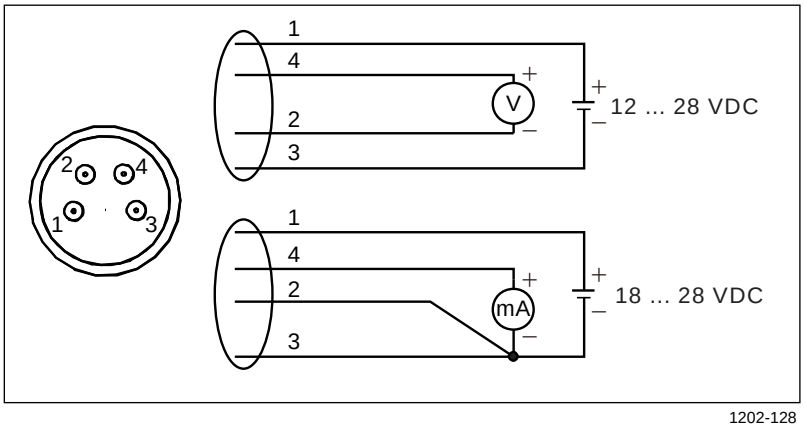


Figure 10 Wiring the Analog Connector

Power Supply Requirements

The minimum supply voltage required by the DMT143 transmitter depends on the analog output type that is used:

- For voltage output: 12 ... 28 VDC.
- For current output: 18 ... 28 VDC. The maximum load is 500 Ω.

The power supply should maintain the voltage for all load conditions.

If measuring in pressures above 20 bara (290 psia) or temperatures below 0 °C, the supply voltage must be 24 ... 28 VDC.

Current consumption during normal operation is <10 mA. The consumption increases during the sensor self-diagnostics (auto-calibration and sensor purge). The maximum current consumption is 220 mA pulsed current. See Figure 11 on page 24 and Figure 12 on page 25.

NOTE	The DMT143 can be powered by the MI70 indicator or the USB service cable. You can plug in the MI70 indicator or the USB service cable to the digital port while the transmitter is powered from the analog port.

Figure 11 below shows a typical duty cycle during sensor purge at room temperature with 24 VDC supply voltage. Sensor purge current varies with supply voltage and operating temperature. The peak value is the highest in the lowest temperature.

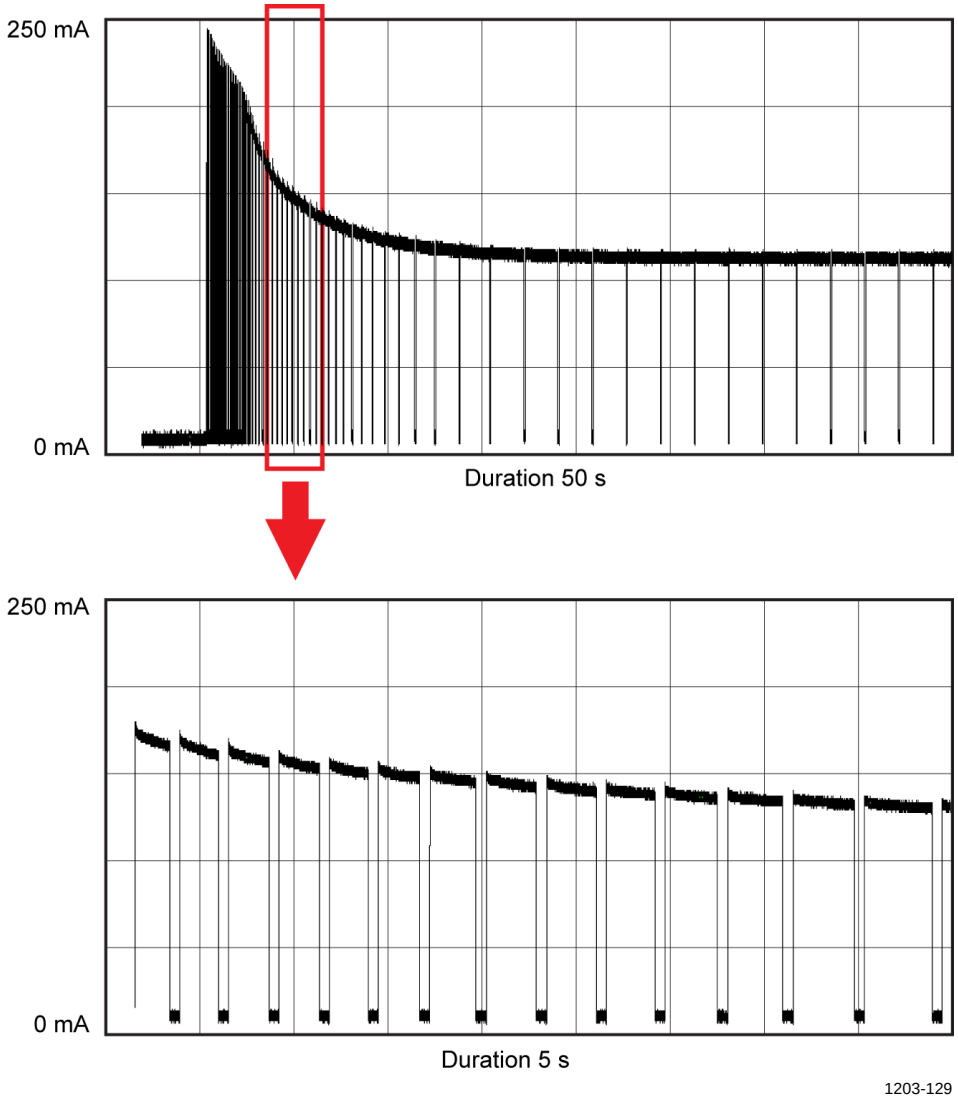


Figure 11 Example of Current Consumption During Purge

Figure 12 below shows a typical duty cycle during auto-calibration at room temperature with 24 VDC supply voltage. Also the auto-calibration current varies with supply voltage and operating temperature.

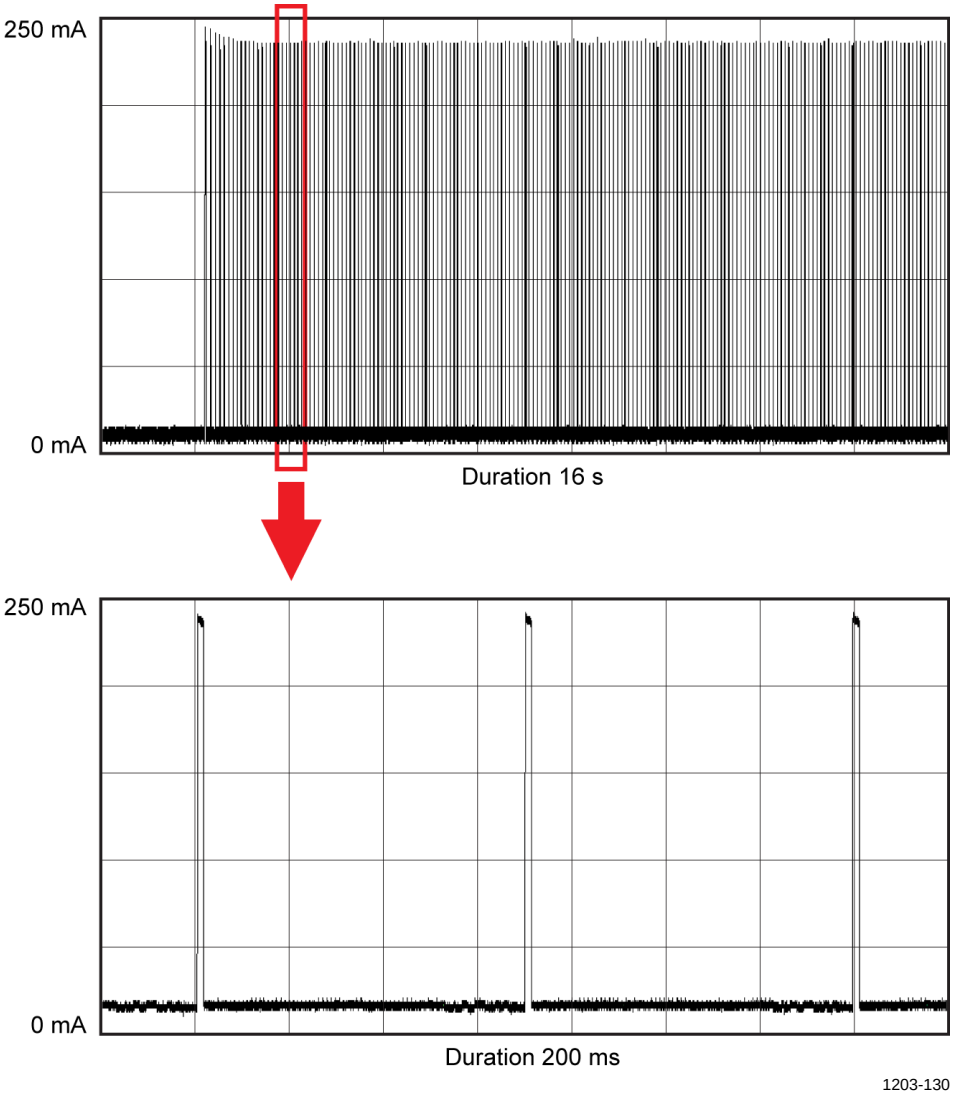


Figure 12 Example of Current Consumption During Auto-Calibration

Sampling from a Process

Sampling is needed when direct measurement of the air or gas is not possible or desirable. This may be related to, for example, a high process temperature, protecting the sensor from water spikes, the need to easily detach the instrument from a pressurized process without running the whole process down, or wanting to make the measurement at a more convenient location.

It is important to keep in mind that changing the pressure of a gas changes the dewpoint temperature of the gas. If the sensor is at a different pressure than the process itself, there may be an error of several tens of degrees in the dewpoint measurement.

Make sure there is sufficient flow of gas to the sensor (for example, 1 l/min) to give a representative sample.

You can use the Vaisala Humidity Calculator to simulate the effect of pressure change to dewpoint. The Humidity Calculator can be found at: www.vaisala.com/humiditycalculator .

Sampling Accessories

DMT242SC Sampling Cell

The DMT242SC is a basic sampling cell with only the main sampling cell body. The inlet and outlet are female threaded sample connectors (inlet G3/8", outlet G1/4" ISO). Refer to Figure 13 on page 27.

The DMT242SC is suitable for users requiring only a sampling cell to fit the transmitter into and doing further assembly (piping into inlet & outlet, valves, possible flow meter) by themselves.

DMT242SC2 Sampling Cell with Swagelok Connectors

The DMT242SC2 is similar to DMT242SC, but connections are made easy. The sampling cell includes welded swagelok connectors at both the inlet and outlet that fit directly to 1/4" tubing.

To fit 6 mm tubing to the connectors, an adapter such as Swagelok® Reducer SS-6M0-R-4 (not supplied by Vaisala) can be used.

DMT242SC2 is the suitable choice in, for example, plastics drying systems, where the measurement is made by tapping off the dryer system and bringing a small air stream to the sensor. The swagelok connectors of DMT242SC2 easily connect to a cooling coil or tubing providing the

essential function of cooling the dry air to ambient temperature before it reaches the sensor.

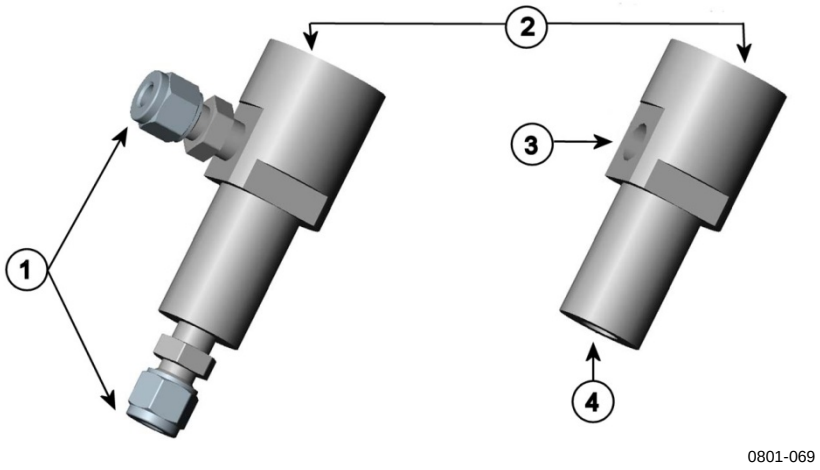


Figure 13 Sampling Cells DMT242SC2 (left) and DMT242SC (right)

where

1 = Male pipe welded connector Swagelok 1/4"
2 = G1/2"
3 = G1/4"
4 = G3/8"

DSC74 Sampling Cell with Quick Connector and Leak Screw

The DSC74 has been designed especially for compressed air lines. The sampling cell contains an adjustable leak screw that allows keeping up the pipeline pressure at the sensor. The leak screw is opened and closed with a screwdriver. The leak screw should be 1/2 turn open. This can be verified by first closing the leak screw, then turning 1/2 turn to open it. Then the air coming out will make a barely audible little hiss and it can be lightly felt when putting a hand in front of the air stream.

NOTE	Do not open the leak screw more than 1/2 turn to avoid reducing the pressure in the sampling cell.

The DSC74 comes with a quick connector that fits to industry standard compressed air line connectors (suitable for type D, Quick08, NIP08). This allows for easy installation and detachment of the dewpoint transmitter without having to shut down the process. Alternative ways to connect are through the two different thread adapters (G3/8" to G1/2" and G3/8" to G1/4" ISO) that are supplied with each DSC74 unit.

When using the DSC74, seal the threads of the quick connector or thread adapter carefully with PTFE thread seal tape. Tighten with an open-end wrench.

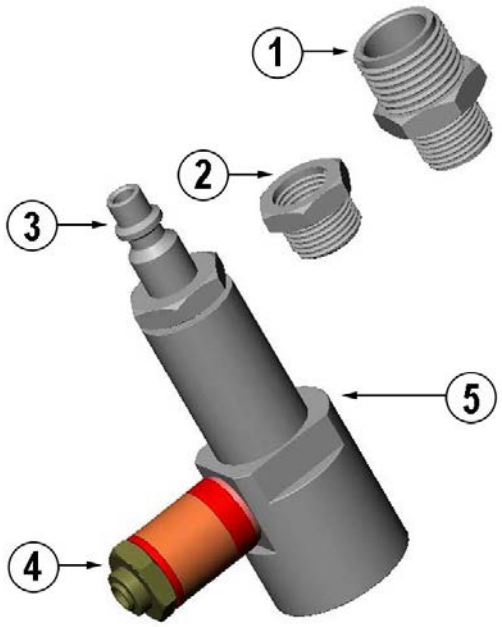


Figure 14 DSC74 Sampling Cell with Accessories

where

1 = Thread adapter type G3/8" - G1/2"
2 = Thread adapter type G3/8" - G1/4"
3 = Quick connector
4 = Leak screw
5 = Sampling cell body (DMT242SC)

DSC74B Two-Pressure Sampling Cell

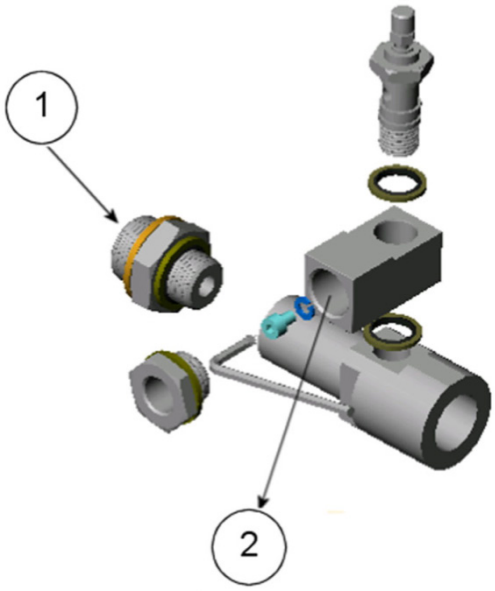
The DSC74B and DSC74C sampling cells are enhanced versions of the DSC74. The body is designed in a way that it is possible to measure at both system pressure and atmospheric pressure.

The DSC74B limits the flow rate with a fixed leak screw. The flow is optimized for pressures 3 ... 10 barg. The fixed leak screw eliminates the risk of opening the leak screw fully by accident and this way emptying a gas vessel. The maximum flow can be increased, if needed, by removing the leak screw and adjusting the flow manually with the valve. Harmful gases can be recovered by connecting a collection system at the outlet (not available from Vaisala).

In the basic operation of the DSC74B, the gas flows to the sensor from the front and the outlet is on the side. To have the measurement done at atmospheric pressure, the inlet and outlet are reversed. Then the reducing parts supplied (G3/8" - G1/2" or G3/8" - G1/4") on the outlet side help to protect the sensor from ambient humidity coming in.

DSC74B parts are:

- Sampling cell, thread G3/8"
- Connection part with a needle valve and an integrated leak screw
- Reducing Nipple (thread adapter), G3/8" - G1/2"
- Reducing Adapter (thread adapter), G3/8" - G1/4"



0510-032

Figure 15 DSC74B

where

1 = Gas goes in
2 = Gas comes out

0510-033

Figure 16 Removing the Leak Screw

DSC74C Two-Pressure Sampling Cell with Coil

The DSC74C with an outlet coil is designed for the most critical measurements at atmospheric pressure. In the DSC74C, the coil is connected to the sampling cell outlet to protect the sensor from ambient humidity disturbing the measurement. The coil can also be used as a cooling coil for sampling from high temperature processes.

DSC74C parts are:

- Sampling cell, thread G3/8"
- Connection part with a needle valve and an integrated leak screw
- Reducing Nipple (thread adapter), G3/8" - G1/2"
- Reducing Adapter (thread adapter), G3/8" - G1/4"
- Diffusion coil (for measurements in atmospheric pressure)

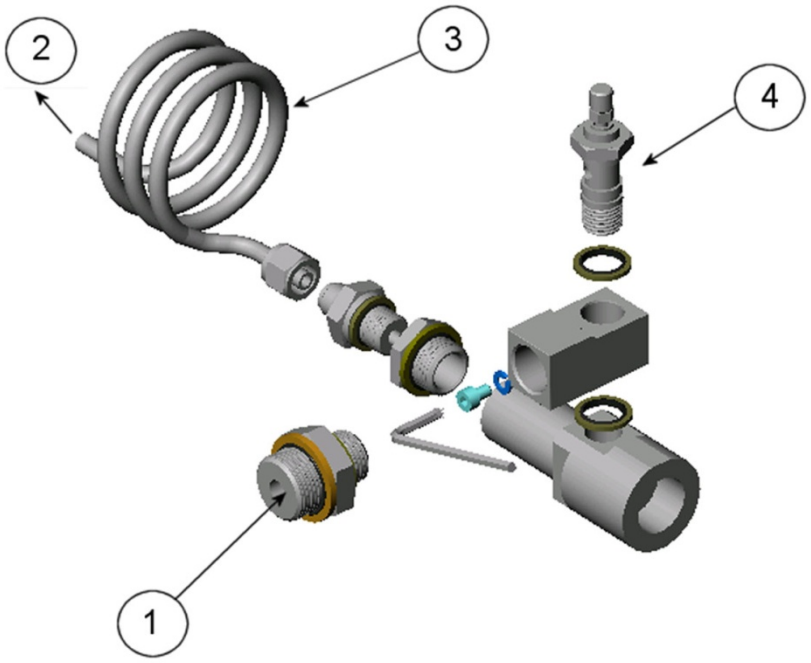


Figure 17 Default Assembly of DSC74C

where

1 = Gas goes in. The coil can also be used here.
2 = Gas comes out
3 = Coil
4 = Valve

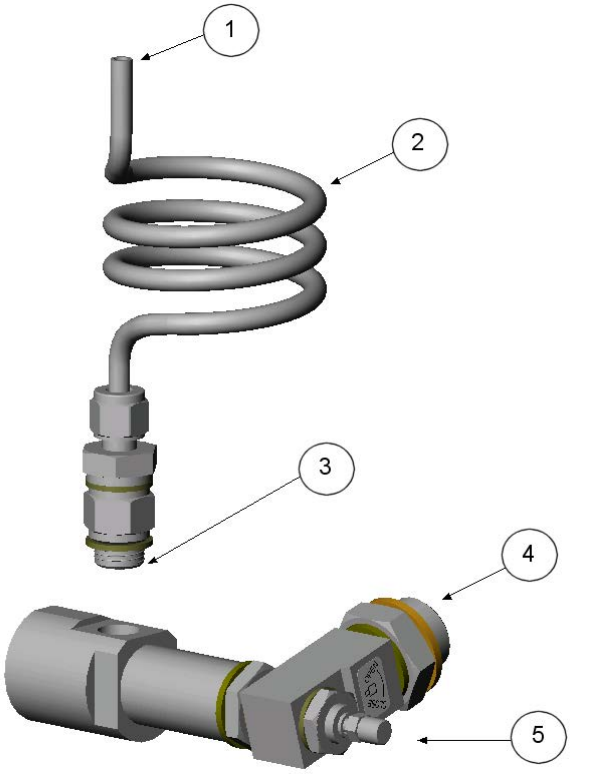


Figure 18 Alternative Assembly of DSC74C (for Tight Spaces)

where

1 = Gas comes out
2 = Coil
3 = Thread, max. size 7 mm
4 = Gas goes in
5 = Valve

The thread size cannot exceed 7 mm. Use the provided adapter to avoid damage to the transmitter.

DM240FA Duct Installation Flange

DMT143 transmitter with the G1/2” ISO228/1 connection thread be installed directly in the process wall through DM240FA duct installation flange. When the transmitter is installed directly on the process wall or pipe, note that a closing valve may be needed on both sides of the installed transmitter so that the sensor head can be removed from the process for calibration or maintenance.

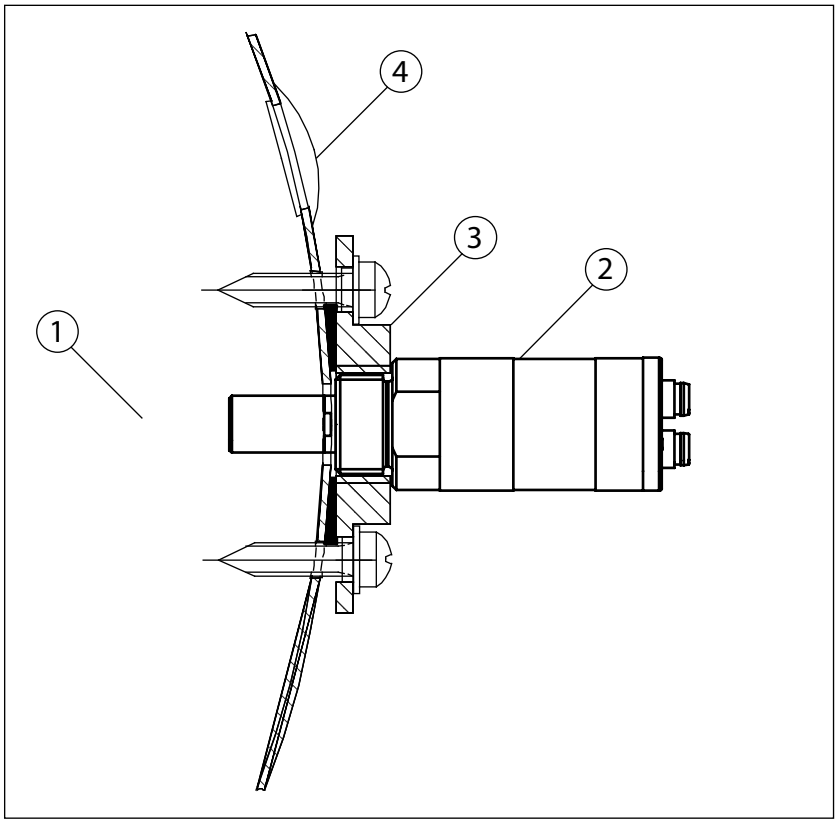


Figure 19 DM240FA with DMT143

where

1 = Measured gas
2 = DMT143 transmitter
3 = DM240FA flange (thread G1/2” ISO228/1)
4 = Recommended additional hole (plugged) for T_d field check reference measurement probe (for example, Vaisala DM70)

CHAPTER 5
OPERATION

This chapter contains information that is needed to operate the DMT143.

Transmitter Start-Up

When the transmitter is connected to power supply, there is a delay of two seconds as the transmitter starts up. After the start-up is complete, the measurement data is available from the analog output and serial line.

For a description of how the diagnostic functions of the sensor affect the availability of live measurement at start-up, see section DMT143 Startup Sequence on page 17.

If serial line output is used, note that the transmitter will behave according to the configured serial mode:

- In STOP mode, the transmitter outputs the transmitter model and software version. This is the default mode.
- In RUN mode a measurement output starts immediately.
- In POLL mode the transmitter does not output anything after power-up.

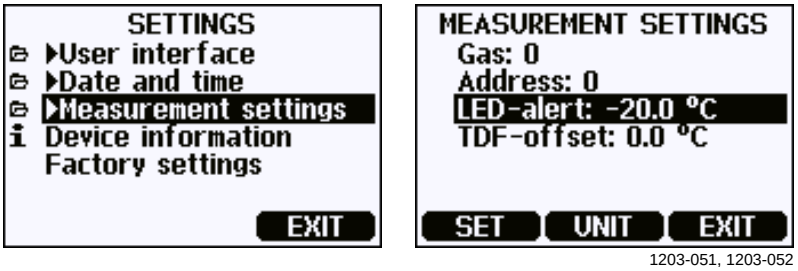
For a description of the modes, see section Set Serial Line Operating Mode on page 53.

Operation with DM70 Hand-Held Dewpoint Meter

You can connect the DMT143 to the MI70 indicator (the measurement display that is included in the DM70 package) using the MI70 connection cable (order code 219980SP). This allows you to view and use the measurement data with the MI70 indicator. You can, for example, perform a field check of the measurement accuracy. For instructions, see section Field Check Using on page 61.

You can adjust the following DMT143 settings in the Measurement settings menu:

- Type of measured gas. The options are:
  - 0 for air
  - 1 for SF_6
- Transmitter address in POLL mode.
- Alarm LED dewpoint limit (not shown if dewpoint alarm is disabled or LED is completely turned off).
- Offset correction for dewpoint measurement. The maximum offset you can set is ±5 °C.



1203-051, 1203-052

Figure 20 Measurement Settings Menu

NOTE You can also return the DMT143 to its factory configuration by using the **Factory settings** option in the **Settings** menu. This option is equivalent to using the **FRESTORE** command on the serial line. Note that also the MI70 indicator will revert to its factory configuration when using the **Factory settings** option on the MI70.

Serial Communication

Connecting to the Serial Interface

DMT143 can be connected to a PC using the RS-485 line on the Digital port. It is recommended that you use the USB service cable (Vaisala order code 219690) for the connection, since the cable also provides the operating power from the USB port.

If you have not used the USB service cable before, install the driver that came with the cable. Refer to section Installing the Driver for the USB Service Cable below for detailed instructions.

Installing the Driver for the USB Service Cable

Before taking the USB service cable into use, you must install the provided USB driver on your PC.

1. Check that the USB service cable is not connected. Disconnect the cable if you have already connected it.
2. Insert the media that came with the cable, or download the latest driver from www.vaisala.com.
3. Execute the USB driver installation program (setup.exe), and accept the installation defaults. The installation of the driver may take several minutes.
4. After the driver has been installed, connect the USB service cable to a USB port on your PC. Windows will detect the new device, and use the driver automatically.
5. The installation has reserved a COM port for the cable. Verify the port number, and the status of the cable, using the **Vaisala USB Instrument Finder** program that has been installed in the Windows Start menu.

Windows will recognize each individual cable as a different device, and reserve a new COM port. Remember to use the correct port in the settings of your terminal program.

There is no reason to uninstall the driver for normal use. However, if you wish to remove the driver files and all Vaisala USB cable devices, you can do so by uninstalling the entry for **Vaisala USB Instrument Driver** from the **Programs and Features** menu in the Windows Control Panel. In Windows XP and earlier Windows versions the menu is called **Add or Remove Programs.**

Terminal Application Settings

The serial interface settings of the DMT143 RS-485 line are presented in Table 6 below.

Table 6 Default Serial Interface Settings

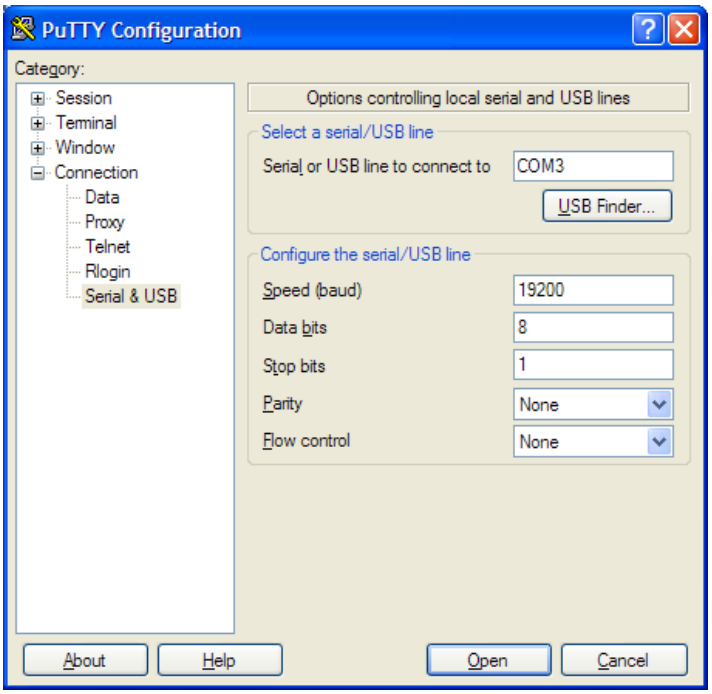
Property	Description / Value
Baud rate	19200
Parity	None
Data bits	8
Stop bits	1
Flow control	None

The steps below describe how to connect to the DMT143 using the PuTTY terminal application for Windows (available for download at www.vaisala.com) and a USB serial interface cable:

1. Connect the USB serial interface cable between your PC and the RS-485 port of the DMT143 (Digital port).
2. Start the PuTTY application.
3. Select the **Serial** settings category, and check that the correct COM port is selected in the **Serial line to connect to** field.

   Note: You can check which port the USB cable is using with the **Vaisala USB Instrument Finder program** that has been installed in the Windows Start menu.
4. Check that the other serial settings are correct for your connection, and change if necessary. **Flow control** should be set to **None** unless you have a reason to change it.
5. Click the **Open** button to open the connection window and start using the serial line.

   Note: If PuTTY is unable to open the serial port you selected, it will show you an error message instead. If this happens, restart PuTTY and check the settings.
6. You may need to adjust the **Local echo** setting in the **Terminal** category to see what you are typing on the serial line. To access the configuration screen while a session is running, click the right mouse button over the session window, and select **Change Settings...** from the pop-up menu.



0807-004

Figure 21 PuTTY Terminal Application

List of Serial Commands

All commands can be issued either in uppercase or lowercase. In the command examples, the keyboard input by the user is in **bold** type.

The notation <cr> refers to pressing the carriage return (**Enter**) key on your computer keyboard. Enter a <cr> to clear the command buffer before starting to enter commands.

Table 7 List of Serial Commands

Command	Description
<ESC>	Stop the continuous outputting of RUN mode or R command
?	Show device information
??	Show device information (overrides poll mode)
ADDR [0 … 255]	Show or set transmitter address
AERR	Set analog output error level
ALARM	Set dewpoint level for LED alarm
AMODE	Show analog output mode
AOUT [ON/OFF]	Enable or disable analog output
AOVER [ON/OFF]	Allow analog outputs to exceed their range 10%
ASEL	Set analog output parameter and scaling
ATEST	Test analog output
CLOSE	Close the temporary connection and return the device to POLL mode
ERRS	Display the currently active errors
FILT [0 ... 1]	Set output filtering level
FORM [modifier string]	Set output format
FRESTORE	Restore factory settings
GAS [0 ... 1]	Set measured gas type
HELP	Show list of currently available serial commands
INTV [0 ... 255 S/MIN/H]	Set the continuous output interval (for RUN mode and R command)
L	Show user adjustment values
LI	Set user adjustment values
OPEN [0 … 255]	Open a line to transmitter at defined address
PRES [0.001 ... 50]	Set permanent pressure compensation value
R	Start the continuous outputting
RESET	Reset the transmitter
SDELAY [0 … 255]	Set response sending delay
SEND [0 … 255]	Output readings once (specify address for transmitters in POLL mode)
SERI [baud p d s]	Show or set the serial interface settings
SMODE [mode]	Show or set startup serial mode: RUN, STOP, or POLL
SNUM	Display transmitter serial number
SYSTEM	Show transmitter firmware information
TIME	Show transmitter uptime
UNIT [m/n]	Select metric or non-metric units
VERS	Show transmitter firmware version
XPRES [0.001 ... 50]	Set temporary pressure compensation value

Device Information

Show Device Information

The **?** command outputs a listing of device information.

?<cr>

Command **??** is a similar command that is designed to be used if the transmitter is in POLL mode but its address is unknown. The transmitter will respond to the **??** command even while in POLL mode. Do not use the **??** command if you have more than one transmitter on an RS-485 line.

Example:

```
?
DMT143 1.0.2
Serial number  : H1220011
Batch number   : H1210003
Sensor number  : G3320000
Sensor model   : DRYCAP180D
Cal. date      : 20120412
Cal. info      : VAISALA/HEL
Time           : 01:38:00
Serial mode    :     STOP
SCI  Baud P D S: 19200 N 8 1
Output interval:        1 S
Serial delay   :       30
Address        :        0
Pressure       :    1.013 bar
Filter         :    0.100
```

Show Analog Output Mode

Use the **AMODE** command to show the analog output mode:

AMODE<cr>

Example:

```
amode
Ch1 output     : 4 ... 20 mA
```

Show Firmware Version

VERS<cr>

Example:

```
vers
DMT143 1.0.2
```

Show Firmware Information

SYSTEM<cr>

Example:

```
system
Device Name          : DMT143
Copyright            : Copyright (c) Vaisala Oyj 2012. All
rights reserved.
SW Name              : DMT143
SW date              : 2012-05-10
SW version           : 1.0.2
```

Show Currently Active Errors

Use the **ERRS** command to display the currently active transmitter error messages. Possible errors and their causes are listed in Table 13 on page 64.

ERRS<cr>

Example:

```
errs
No errors
```

Example (one active error, caused by physical damage to the sensor):

```
errs
T MEAS error
```

Show Serial Number

SNUM<cr>

Example:

```
snum
Serial number  : G4060003
```

Show Command List

Use the **HELP** command to show a list serial commands:

HELP<cr>

Example:

```
help
?
ADDR
AERR
ALARM
AMODE
AOVER
AOUT
ASEL
ATEST
CLOSE
ERRS
FILT
FORM
FRESTORE
GAS
HELP
INTV
L
LI
OPEN
PRES
R
RESET
SDELAY
SEND
SERI
SMODE
SNUM
SYSTEM
TIME
UNIT
VERS
XPRES
```

Configuring Analog Output

Set Analog Output Parameters and Scaling

Use the **ASEL** command to show or set the output parameter and the scaling of the analog output.

ASEL [*parameter*] [*lowlimit highlimit*]<cr>

where

parameter = Parameter that is output on analog channel. Available parameters are TDF, TDFA, H2O. If the transmitter has been ordered from Vaisala with a relative humidity output on the analog channel, also parameter RH is available.
lowlimit = Lower limit of parameter scaling.
highlimit = Higher limit of parameter scaling.

Example (show current settings):

```
asel
Ch1 Tdf  lo    :   -80.00 'C ?
Ch1 Tdf  hi    :    20.00 'C ?
```

Example (change output parameter to H2O, set low and high limits):

```
asel h2o 0 6000
Ch1 H2O  lo    :     0.00 ppm
Ch1 H2O  hi    :  6000.00 ppm
```

Set Analog Output Error Notification

If the transmitter is malfunctioning, the analog output is set to a specified level. This overrides the normal measurement output of the channel. The default level is 0 mA or 0V, according to the output type. You can set the level using the **AERR** command.

AERR [*level*]<cr>

where

level = Error level for the analog output channel. Available range depends on the output type (check with **AMODE** command).

Example (check settings):

```
amode
Ch1 output     : 4 ... 20 mA

aerr
Ch1 error out  :    0.000 mA
```

Example (set analog channel error level to 20 mA):

```
aerr 20
Ch1 error out  :   20.000 mA
```

NOTE The error output value is displayed only when there are minor electrical faults such as a sensor damage. When there is a severe device malfunction, the error output value is not necessarily shown.

Extend Analog Output Range

Use the **AOVER** command to allow the analog output channels to exceed their specified range by 10%. The scaling of the parameter remains as before; the extra range is used for additional measurement range in the high end of the scale.

AOVER [*ON/OFF*]<cr>

Example (turning AOVER on):

```
aover on
AOVER                :        ON
```

The following example illustrates how the analog output is affected. The channel outputs T_d with voltage output 0 … 5 V (-80 … -30 °C). After giving the **AOVER ON** command, the range is 0 … 5.5 V (-80 … -25 °C). Note that the -30 °C T_d point is still at 5 V.

Test Analog Output

You can test the operation of the analog output with the **ATEST** command by forcing the output to a given value. You can then measure the output with a calibrated multimeter. After testing the output, give the **ATEST** command again to exit the test mode.

ATEST [*level*]<cr>

where

level = Level for analog output channel.
Analog output type determines if the value is V or mA.

The command output shows the test value of the analog output as well as diagnostic information that may be useful to Vaisala Service if there is a problem with the analog output.

Example (enabling analog output test mode, setting level to 20 mA):

```
atest 20
  20.000    27407
```

Example (disabling analog output test mode, resuming normal output):

```
atest
   0.000    15831
```

Enable or Disable Analog Output

Use the AOUT command to enable or disable the analog output channel.

AOUT [*ON/OFF*]<cr>

Example (turn analog output off):

```
aout off
AOUT                :       OFF
```

Serial Line Output Commands

Start Measurement Output

Use the **R** command to start the continuous outputting of measurement values as an ASCII text string to the serial line. The format of the measurement message is set with the **FORM** command.

R<cr>

Example (measurement message in default format):

```
r
Tdf= 17.75 'F Tdfatm= -5.25 'F H2O=   954 ppm
Tdf= 17.23 'F Tdfatm= -5.72 'F H2O=   930 ppm
Tdf= 17.06 'F Tdfatm= -5.88 'F H2O=   922 ppm
Tdf= 16.97 'F Tdfatm= -5.96 'F H2O=   918 ppm
...
```

Outputting the results continues in intervals issued with the command **INTV** until stopped.

Stop Measurement Output

You can stop the measurement output by pressing the **ESC** key.

Set Output Interval

Use the **INTV** command to change the output interval of the automatically repeating measurement messages. The measurement messages are repeated in the RUN mode, or after the **R** command has been given.

INTV [*n xxx*]<cr>

where

n	=	time interval, range 0 ... 255
xxx	=	time unit = "S", "MIN", or "H"

The shortest output interval (with n = 0) outputs the measurement messages as quickly as the transmitter's internal measurement cycle produces them, without additional delay.

Example:

```
intv 1 min
Output interval:        1 MIN
```

Output a Reading Once

Use the **SEND** command to output a single measurement message. The output message is sent in the format that has been set using the **FORM** command.

SEND [*address*]<cr>

where

address = Address of the transmitter, range 0 ... 255.

Specifying the address is only necessary if the target transmitter is in POLL mode, and has not been accessed with the **OPEN** command.

Example:

```
send
Tdf= 16.71 'F Tdfatm= -6.19 'F H2O=   907 ppm
```

Configuring Measurement Parameters

Set Measurement Output Format

Use the serial line command **FORM** to change the measurement message sent by the transmitter. You can freely define the output message to include the desired parameters, formatting options, text strings, and additional fields.

FORM [*modifier string*]<cr>

where

modifier string = String of parameters and modifiers that defines the output format, length 1 ... 153 characters. Maximum length may be shorter when text strings are used. See Table 8 and Table 9 on page 48, and examples below.

You can return to the default format using the "**FORM** /" command.

Example of default output (continuous output from RUN mode):

```
Tdf= -9.80 'C Tdfatm= -9.80 'C H2O=  2618 ppm
Tdf= -9.80 'C Tdfatm= -9.80 'C H2O=  2617 ppm
...
```

Command to set output format as Tdf and ppm with Modulus-256 checksum:

```
form 3.2 "Tdf=" Tdf U3 6.0 "H2O=" H2O " " U5 CS2 \r \n
```

Output example:

```
Tdf= -9.74'C H2O=  2632 ppm  C4
Tdf= -9.72'C H2O=  2636 ppm  C6
...
```

Command to set output format as Tdf and ppm, with **start of text** (ASCII character 002) and **end of text** (003) ASCII codes, and without line feed and carriage return at the end:

```
form #002 3.2 "Tdf=" Tdf U3 6.0 "H2O=" H2O " " U5 #003
```

Output example (ASCII codes not visible here):

```
Tdf= -9.57'C H2O=  2671 ppm  Tdf= -9.59'C H2O=  2666 ppm
Tdf= -9.61'C H2O=  2662 ppm  Tdf= -9.62'C H2O=  2660 ppm
...
```

Table 8 FORM Command Parameters

Measured Parameter	Abbreviation in FORM Command
Dewpoint/frost point temperature	Tdf
Dewpoint/frost point temperature, converted to atmospheric pressure	Tdfa
ppm moisture, by volume	H20
Relative humidity*	RH

* RH is available only if transmitter has been ordered from Vaisala with a relative humidity output on the analog channel.

Table 9 FORM Command Modifiers

Modifier	Description
x.y	Length modifier (number of digits and decimal places)
#t	Tabulator
#r	Carriage-return
#n	Line feed
""	String constant, length 1 ... 15 characters
#xxx	ASCII code value (decimal) of a special character; for example, **#027** for ESC
ADDR	Transmitter address (0 ... 255)
ERR	Currently active transmitter errors in a four bit field: bit0bit1bit2bit3bit4 bit0 T MEAS error bit1 N/A bit2 Fmeas error bit3 Flash csum error
SN	Transmitter serial number
STAT	Transmitter status in a one character field: h – sensor heating active H – Purge active A – Autocalibration active
TIME	Time since transmitter was started or reset
Ux	Shows the name of the measurement unit using “x” number of characters. For example, **U3** shows the name of the measurement unit with three characters
CS2	Modulus-256 checksum of message sent so far, ASCII encoded hexadecimal notation
CS4	Modulus-65536 checksum of message sent so far, ASCII encoded hexadecimal notation
CSX	NMEA xor-checksum of message sent so far, ASCII encoded hexadecimal notation

Set Measured Gas Type

Use the **GAS** command to set the type of gas that is measured.

GAS [*type*]<cr>

where

type = Measured gas type. Options are:
0 = air
1 = SF_6

Example (change currently measured gas from air to SF_6):

```
gas
Gas             :       0     ? 1
```

Set Measurement Filtering

Use the **FILT** command to view or set the speed at which the latest measurement result is integrated into the output readings. The command affects both analog output and serial line output.

FILT [*a.aaa*]<cr>

where

a.aaa = Range 0.001 ... 1.0.
1.0 = No filtering, latest measurement is output without averaging
0.5 = Average of last two measurements
0.1 = Average of ca. 16 measurements (default)

Example (show current setting):

```
filt
Filter          :    0.100     ?
```

Example (set filtering to 0.5):

```
filt 0.5
Filter          :    0.500
```

Set Pressure Compensation Value

The pressure of the measured system must be known for accurate dewpoint and ppm measurement. The pressure compensation value has been set at the factory according to the order form. You can view and set a new value using the **PRES** command.

Command **XPRES** should be used if the value is changed frequently. The value set using the **XPRES** command overrides the **PRES** value, but it is not retained at reset. When the **XPRES** is set to 0, the last value set with **PRES** is used instead.

NOTE It is enough to set an approximate pressure value (±1 bar) to meet the accuracy specification of the DMT143.

PRES [*pp.ppppp*]<cr>

XPRES [*pp.ppppp*]<cr>

where

pp.ppppp = Absolute pressure (bar_a) in the measuring point. Range 0.001 ... 50 bar.

Example (set pressure compensation value to 3 bar):

```
pres 3
Pressure       :    3.000 bar
```

The pressure conversion coefficients from other pressure units to bars is given in the table below.

Table 10 Pressure Conversion Coefficients

From	To bar_a
PaN/m²	0.00001
mmHg torr	0.001333224
inHg	0.03386388
mmH_2O	0.00009806650
inH_2O	0.002490889
atm	1.01325
at	0.980665
psi_a	0.06894757

For example: 29.9213 inHg = 29.9213 × 0.03386388 = 1.01325 bar_a.

Select Unit

Use the **UNIT** command to select metric or non-metric output units.

UNIT [*x*]<cr>

where

x = Selects the unit type to output:
m = metric units, for example, Celsius
n = nonmetric units, for example, Fahrenheit

Example:

```
unit m
Units          : Metric
```

View User Adjustment Parameters

Use the **L** command to view the current user adjustment parameters that are affected by the **LI** command and the MI70 (Tdf offset only). This command is useful for checking the currently applied correction.

L<cr>

The output values are as follows:

- RH offset and gain
- T offset and gain
- Tdf offset and gain

Example (shows default values, no user adjustment done):

```
l
RH offset :   0.00000000E+00
RH gain   :   1.00000000E+00
T  offset :   0.00000000E+00
T  gain   :   1.00000000E+00
Tdf offset:   0.00000000E+00
Tdf gain  :   1.00000000E+00
```

Example (shows that a -1.2 °C Tdf offset has been applied by the user):

```
l
RH offset :   0.00000000E+00
RH gain   :   1.00000000E+00
T  offset :   0.00000000E+00
T  gain   :   1.00000000E+00
Tdf offset:  -1.20000000E+00
Tdf gain  :   1.00000000E+00
```

Set User Adjustment Parameters

Use the **LI** command to set the user adjustment parameters directly. This command is useful for restoring the desired adjustments, and removing the effects of user adjustment without having to perform the factory reset.

CAUTION	This command is provided primarily for applying an offset to the Tdf measurement. Do not adjust the other parameters unless instructed to do so by a Vaisala Service Center.

LI<cr>

After entering the command, you will be prompted to enter new values one at a time. Press ENTER without giving a value to move to the next parameter.

Example (shows a +0.8 °C Tdf offset being applied):

```
li
RH offset :   0.00000000E+00  ?
RH gain   :   1.00000000E+00  ?
T  offset :   0.00000000E+00  ?
T  gain   :   1.00000000E+00  ?
Tdf offset:   0.00000000E+00  ? 0.8
Tdf gain  :   1.00000000E+00  ?
```

Configuring Serial Line Operation

Set Serial Line Operating Mode

Use the **SMODE** command to set the start-up operating mode of the serial line.

SMODE [*mode*]<cr>

where

mode = STOP, RUN, or POLL.

Table 11 Selection of Output Modes

Mode	Measurement Output	Available Commands
STOP	Only with the **SEND** command.	All (default mode).
RUN	Automatic output.	Only command **S.**
POLL	Only with the **SEND** [*addr*] command.	**SEND** [*addr*] and **OPEN** [*addr*]. Other commands available after opening a line to the transmitter using the **OPEN** command. Use with RS-485 buses where multiple transmitters can share the same line.

Selected output mode will be activated at next reset or power up.

Example:

```
smode poll
Serial mode    :     POLL
```

Set Serial Line Settings

Use the **SERI** command to set the serial line settings. The new settings will be taken into use when the transmitter is reset or powered up.

Note that changing the serial line settings will slightly alter how the transmitter works with the MI70 indicator. If you are not using the default settings of 19200 N 8 1, you will have to power off the MI70 before it can find the transmitter (you will not be able to connect it on-the-fly).

SERI [*b p d s*]<cr>

where

b = baud rate (4800, 9600, or 19200)
p = parity (n = none, e = even, o = odd)
d = data bits (7 or 8)
s = stop bits (1 or 2)

Example (set serial line to 9600 baud, no parity, 7 data bits, and 1 stop bit):

```
seri 9600 e 7 1
SCI  Baud P D S: 9600 E 7 1
```

Set Transmitter Address

To operate in the POLL mode, the transmitter must have an address. If multiple transmitters share the same serial line, each transmitter must have a different address.

For a description of the serial interface modes, see section Set Serial Line Operating Mode on page 53.

ADDR [*address*]<cr>

where

address = Transmitter address, range 0 ... 255.

Example:

```
addr
Address        :        0     ?
```

Set Serial Line Response Time

With the **SDELAY** command you can set delay (response time) of the serial line, or view the currently set delay value.

SDELAY [*delay*]<cr>

where

delay = Serial line delay, range 0 … 255. One unit of delay corresponds to 4 milliseconds.

Example (set delay to 120 milliseconds):

```
sdelay 30
Serial delay   :        30
```

Other Commands

Opening the Transmitter in POLL Mode

Use the **OPEN** command to connect to a transmitter that is in POLL mode.

OPEN [*address*]<cr>

where

address = Transmitter address, range 0 ... 255.

Example (target transmitter in POLL mode, with address 5):

```
open 5
DMT143   5 line opened for operator commands
```

Closing the Connection to a Transmitter in POLL Mode

The **CLOSE** command closes the connection to a transmitter.

CLOSE<cr>

Example:

```
close
line closed
```

Configure the Alarm LED

Use the **ALARM** command to configure the alarm LED functionality. For more information on the LED, see section Alarm LED on page 18.

ALARM [*LED*] [*Alarm*] [*Level*]<cr>

where

LED = Enable or disable the entire LED functionality.
Allowed values:
ON - Enable the LED functionality.
OFF - Turn off the LED completely.

Alarm = Enable or disable the dewpoint alarm.
Allowed values:
ON - Enable the dewpoint alarm.
OFF - Turn off the dewpoint alarm.

Level = Dewpoint temperature above which the alarm LED will turn red. The LED will turn green when the measured dewpoint temperature falls below this level. Range -60 ... +60 °C Tdf.

Example (show current settings):

```
alarm ?
LED display    :       OFF
Alarm display  :       OFF
Setpoint Td(°C):   -10.00
```

Example (change values line by line, enter to skip line):

```
alarm
LED display    :      OFF     ? on
Alarm display  :      OFF     ? on
Setpoint Td(°C):   -10.00     ? -40
```

Example (change alarm level to -40 °C Tdf):

```
alarm on on -40
LED display    :       ON
Alarm display  :       ON
Setpoint Td(°C):   -40.00
```

Example (turn off the dewpoint alarm only):

```
alarm on off
LED display    :       ON
Alarm display  :      OFF
Setpoint Td(°C):   -40.00
```

Example (turn off the LED completely):

```
alarm off
LED display    :      OFF
```

Show Transmitter Uptime

Use the **TIME** command to show how long the transmitter has been operating since it was last reset or powered up.

TIME<cr>

Example:

```
time
Time            : 03:14:10
```

Reset Transmitter

Use the **RESET** command to reset the transmitter.

RESET<cr>

When the **RESET** command is given, the transmitter will restart as if it had just been powered on. All transmitter settings are retained. The serial line mode of the transmitter will be set to the mode that was set using the **SMODE** command.

Restore Factory Settings

Use the **FRESTORE** command to restore the transmitter to its factory configuration. All user settings will be lost.

FRESTORE<cr>

NOTE	After using the **FRESTORE** command, reset the transmitter using the **RESET** command.

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CHAPTER 6

MAINTENANCE

This chapter provides information that is needed in basic maintenance of the DMT143.

Periodic Maintenance

Cleaning

The body of the transmitter can be cleaned by wiping with a moistened lint-free cloth. Do not immerse the transmitter in liquid, and do not use cleaning agents or solvents.

Calibration

DMT143 is fully calibrated as shipped from factory. The recommended calibration interval is two years. If there is a reason to believe that device is not within the accuracy specifications, you can perform a field check using the DM70 hand-held dewpoint meter.

If the field check indicates that the DMT143 is not within its accuracy specifications, contact a Vaisala Service Center or your local Vaisala representative to have the DMT143 adjusted.

Changing the Filter

Replace the filter if it is contaminated. New filters are available from Vaisala; see section Spare Parts and Accessories on page 70.

CAUTION Be careful when changing the filter, since it is easy to break the sensor when the filter is removed.

CAUTION If the transmitter is installed in a pressurized chamber, always make sure that the pressure of the chamber is equalized with the ambient pressure prior to removing the transmitter. When the transmitter is removed for maintenance, cap the hole with a capped nut. This way, the chamber can be pressurized although the transmitter is not in place.

Plugs are available from Vaisala for ISO and NPT threaded connections.

When replacing the filter, wear clean gloves to avoid depositing dirt or oil on the filter. Inspect the sealing ring for damage (used with ISO thread only), and replace it if necessary.

Replace the filter as follows:

1. Turn the filter counterclockwise until it is loose.
2. Pull the filter straight out carefully. **Do not damage the sensor**.

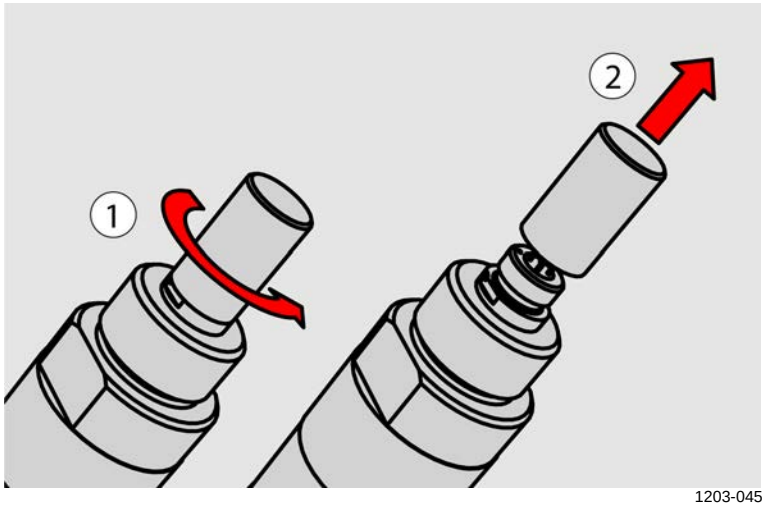

Figure 22 Removing the Filter

3. Take the new filter, and insert it to the filter thread.
4. Tighten the new filter to 5 Nm by turning it clockwise.

Field Check Using the DM70 Hand-Held Dewpoint Meter

Vaisala recommends the following equipment for field checking:

- A fully charged MI70 indicator (the measurement display that is included in the DM70 package).
- A calibrated reference probe that is suitable for the intended measurement environment and dewpoint range. The DMP74B probe is recommended for checking the dewpoint and temperature measurement accuracy.
- You also need a connection cable (Vaisala order code: 219980SP) to connect the DMT143 to the MI70 indicator.

NOTE In the procedure below, the readings of the transmitter and the reference probe are checked simultaneously. You can also check the reference probe and the DMT143 separately if they cannot be connected at the same time.

Perform the check as follows:

1. Place the reference probe and the DMT143 in the reference environment.
2. Connect the reference probe and the DMT143 to the MI70 indicator:
   - Reference probe to Port I
   - DMT143 to Port II
3. Turn on the MI70 indicator.
4. Check and adjust the environment settings if prompted. Refer to the DM70 User's Guide for the settings of the DMP74B probe.
5. Disable the **Auto power off** function of the MI70 indicator to prevent the indicator from powering off in the middle of the check. Check the setting in the **Settings** - **User Interface** menu, and change if necessary.
6. The MI70 can display three parameters at one time. To compare the readings of the DMT143 and the reference probe, select the desired parameter from the **Display** – **Quantities and Units** menu of the MI70. Select the same parameter from port I and II, and the delta parameter that shows the difference between the two. For example, $\Delta \mathbf{T_{d/f}}$ shows the difference in dewpoint between the two probes.

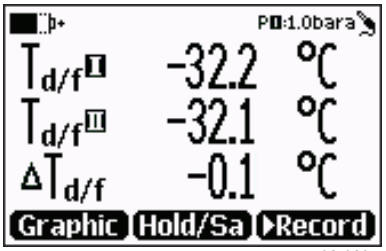

Figure 23 Comparing Dewpoint Readings on MI70

7. After the measurement has stabilized, check the difference between the readings. It will give you an indication of the approximate drift of the DMT143 and its need for calibration. The difference between the readings should be no greater than the combined measurement uncertainty of the DMT143 and the reference probe.
8. Write down the results and repeat the comparison for each parameter you want to check.
9. If adjustment is required, contact a Vaisala Service Center or your local Vaisala representative to have the DMT143 adjusted.

NOTE Some notes on using the MI70 indicator with the DMT143:

- If you disconnect the DMT143 while the MI70 indicator is on, the parameters measured will remain on the screen, but no measurement will be shown.
- Temperature measured by the DMT143 is shown as parameter **Ta** (not T) in the MI70.
- The messages from the transmitter will appear in English even if the MI70 has been set to another language.

Repair Maintenance

CAUTION The transmitter body does not have user serviceable parts inside, and is not designed to be opened. Opening the transmitter will void the warranty.

If there is a problem with your transmitter that you are unable to solve yourself or with the help of the Vaisala Helpdesk, contact a Vaisala Service Center. In case of mechanical or electrical failure, the Service Center may replace the transmitter with a new one.

For troubleshooting instructions and Vaisala contact information, see Chapter 7, Troubleshooting, on page 63.

CHAPTER 7
TROUBLESHOOTING

This chapter describes common problems, their probable causes and remedies, and provides contact information for technical support.

Solving Typical Problems

Some problems can be solved by simply resetting the transmitter. You can reset the transmitter by disconnecting the power or issuing the **RESET** command using the service port.

If resetting does not help, and if the problem is related to transmitter software or settings, you can restore the factory configuration of the transmitter by issuing the **FRESTORE** command. If you are unable to solve your problem with the transmitter, contact Vaisala technical support. See section Technical Support on page 65.

Table 12 Troubleshooting Table

Problem	Possible Causes and Solutions
Transmitter outputs stars "****" on serial line instead of measurement data	Possible causes: damaged sensor, incorrect supply voltage, and unsuitable measurement environment. Power cycle or reset the transmitter, and see if the problem continues. Check the active errors using the **ERRS** command. Check the power supply.
Unable to access transmitter on the RS-485 line.	Possible causes: Incorrect wiring, unknown serial settings, transmitter in POLL mode with unknown address. Check wiring. Try connecting as instructed in section Unknown Serial Settings on page 64. Issue the **??** command to make the transmitter respond in POLL mode.
Analog output seems to be stuck, the measurement is not changing.	Possible causes: Sensor diagnostics in progress (autocal or purge), malfunction error active. Check the active errors using the **ERRS** command. Wait for the diagnostics to complete.
Dewpoint alarm LED is red even though the measured dewpoint is not high.	Possible causes: the alarm limit may be set incorrectly for your application. Check and correct using serial line or MI70 indicator.

Error Messages

The transmitter has error codes that can be displayed on the serial line using the **ERRS** command. See section Show Currently Active Errors on page 40.

Table 13 Error Messages

Error Message	Possible Cause and Solution
T MEAS error	DRYCAP® sensor damaged or missing. Contact a Vaisala service center.
F meas error	
Voltage error	Supply voltage out of range. Check and correct.
Voltage too low error	
Voltage too low for mA output	
Voltage is too low for V output	
Program flash check sum error	Internal transmitter error. If the error remains after a reset and restoring the factory settings, contact a Vaisala service center.
Parameter flash check sum error	
INFOA check sum error	
SCOEFS check sum error	
CURRENT check sum error	

Unknown Serial Settings

If you are not sure what the current serial settings of your transmitter are, follow the steps below to connect to the transmitter. This procedure assumes you have the USB service cable available.

For more information on the USB service cable and the PuTTY terminal application, see section **Serial Communication** on page 35.

1. Connect the USB service cable to your PC, but do not connect it to the transmitter yet.
2. Start a terminal application and open a terminal session using the default serial settings of 19200 8 N 1.
3. Plug the USB service cable into the transmitter, and immediately send the hash character # to the serial line:

   #
4. The normal startup of the transmitter is now interrupted, and the transmitter is available for commands with the default serial settings.
5. You can now check the transmitter's information by issuing the **?** command:

   ?

   The transmitter's currently stored serial settings are visible on the line marked **Baud P D S**.

Technical Support

For technical questions, contact the Vaisala technical support by e-mail at helpdesk@vaisala.com. Provide at least the following supporting information:

- Name and model of the product in question
- Serial number of the product
- Name and location of the installation site
- Name and contact information of a technically competent person who can provide further information on the problem.

Product Returns

If the product must be returned for service, see www.vaisala.com/returns.

For contact information of Vaisala Service Centers, see www.vaisala.com/servicecenters.

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CHAPTER 8

TECHNICAL DATA

This chapter provides the technical data of the DMT143.

Specifications

Table 14 Measured Parameters

Property	Description / Value
Dewpoint temperature	
Measurement range (typical)	-60 ... +60 °C (-76 ... +140 °F) T_d*
Analog output scalings Option 1 Option 2 Option 3	 -80 ...+20 °C (-112 ... +68 °F) T_d -80 ...+20 °C (-112 ... +68 °F) T_d Dewpoint at ambient pressure Free scaling
Accuracy in air or N_2	±2 °C (±3.6 °F) T_d See Figure 24 on page 68.
Response time 63% [90%] at +20 °C (+68 °F), 1 bar pressure -60 -> -20 °C Td (-76 -> -4 °F Td) -20 -> -60 °C Td (-4 -> -76 °F Td)	 5 s [15 s] 45 s [10 min]
PPM volume concentration	
Measurement range	10 ... 40 000 ppm (typical)
Accuracy at +20 °C (+68 °F), 1 bar pressure	 1 ppm + 20% of reading

* When the dewpoint is below 0 °C (32 °F), the transmitter outputs frostpoint.

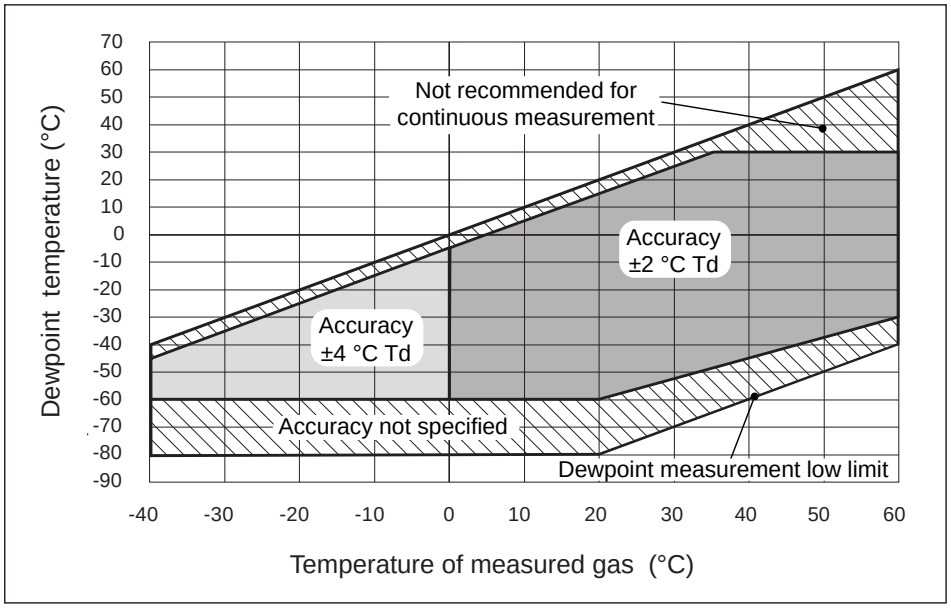

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Figure 24 Dewpoint Accuracy vs. Measurement Conditions

Table 15 Operating Environment

Property	Description / Value
Temperature*	-40 … +60 °C (-40 ... +140 °F)
Relative humidity	0 ... 100 %
Pressure*	0 … 50 bara (0…725 psia)
Measured gases	Non-corrosive gases
Sample flow rate	No effect on measurement accuracy

* For extended temperature down to -40 °C (-40 °F) or pressure up to 50 bara (725 psia) the supply voltage must be 24 ... 28 VDC..

Table 16 Outputs

Property	Description / Value
Analog output (scalable)	4 ... 20 mA (3-wire) 0 ... 1 V/5 V 1 ... 5 V
Resolution for current output	0.002 mA
Resolution for voltage output	0.3 mV
Typical temperature dependence	0.005% of span / °C
Digital output	RS-485, non-isolated Vaisala Industrial Protocol
Connector	4-pin M8 (IEC 60947-5-2)

Table 17 General

Property	Description / Value
Sensor	Vaisala DRYCAP® 180D
Recommended calibration interval to confirm the specified accuracy	2 years
Operating voltage with current output with voltage output with RS-485	 18 ... 28 VDC 12 ... 28 VDC 12 ... 28 VDC
Supply current during normal measurement during self-diagnostics	 Max 10 mA + load current Max. 220 mA pulsed
Load for current output	Max. 500 Ω
Load for voltage output	Min. 10 kΩ
Housing material	Stainless steel (AISI316L)
Sensor protection	Stainless steel sintered filter
Mechanical connection	ISO G1/2” or NPT ½"
Housing classification	IP66 (NEMA4)
Storage temperature range	-40 … +60 °C (-40 ... +140 °F)
Weight ISO G1/2” threaded version NPT 1/2" threaded version	 90g (3.2 oz) 100 g (3.5 oz)
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements - for use in industrial locations.

Spare Parts and Accessories

Table 18 Spare Parts and Accessories for DMT143

Description	Order Code
Connection cable for MI70 Hand-Held Indicator	219980SP
USB service cable	219690
Loop-powered external display, Nokeval 301	226476
Loop-powered external display, Nokeval 302 (with alarm relays)	234759
Installation flange ISO ½	DM240FASP
Sintered filter	DRW010335SP
Stainless steel filter	HM47453SP
Mounting nut	MOUNTINGNUTSP
Plug kit (ISO 1/2")	218773
Plug kit (NPT 1/2")	222507
Sealing ring set (3 pcs)	221525SP
Output cables	
0.3 m (1.0 ft) shielded output cable M8, threaded connector	HMP50Z032SP
3 m (9.8 ft) shielded output cable M8, threaded connector	HMP50Z300SP
5 m (16.4 ft) shielded output cable M8, threaded connector	HMP50Z500SP
10 m (32.8 ft) shielded output cable M8, threaded connector	HMP50Z1000SP
1.5 m (4.9 ft) heavy duty cable	225777SP
3 m (9.8 ft) heady duty cable	225229SP
Sampling cells	
Sampling cell	DMT242SC
Sampling cell with 1/4" male Swagelok connectors	DMT242SC2
Sampling cell with quick connector and leak screw	DSC74SP
Two-pressure sampling cell	DSC74BSP
Two-pressure sampling cell with coil	DSC74CSP
Separate cooling/venting coil for sampling cells	DMCOILSP

Dimensions in mm

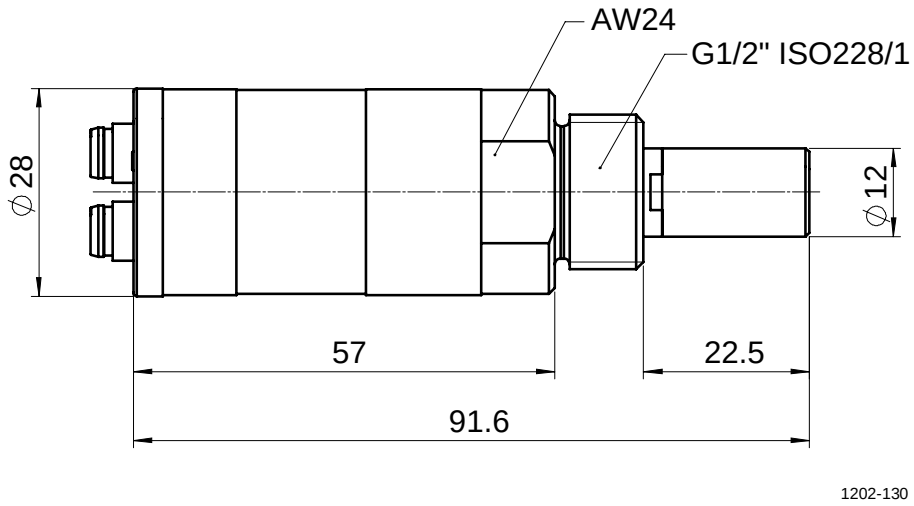


Figure 25 DMT143 Dimensions – Model With ISO Thread

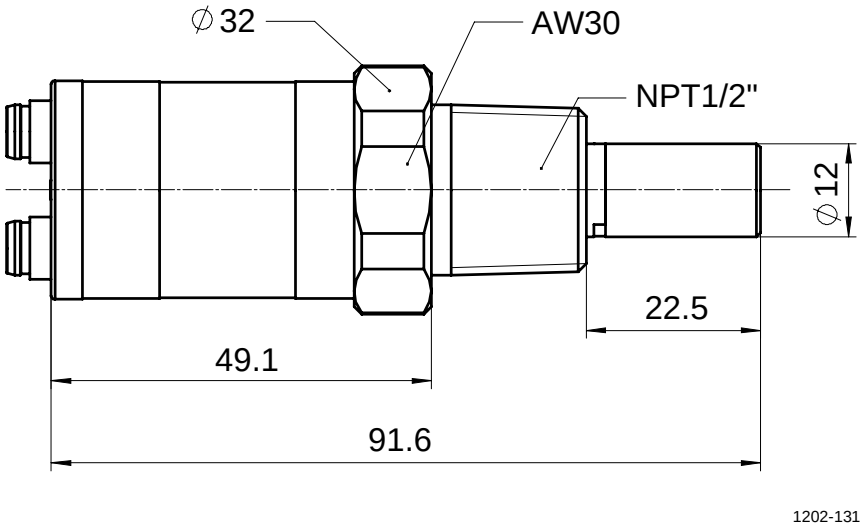
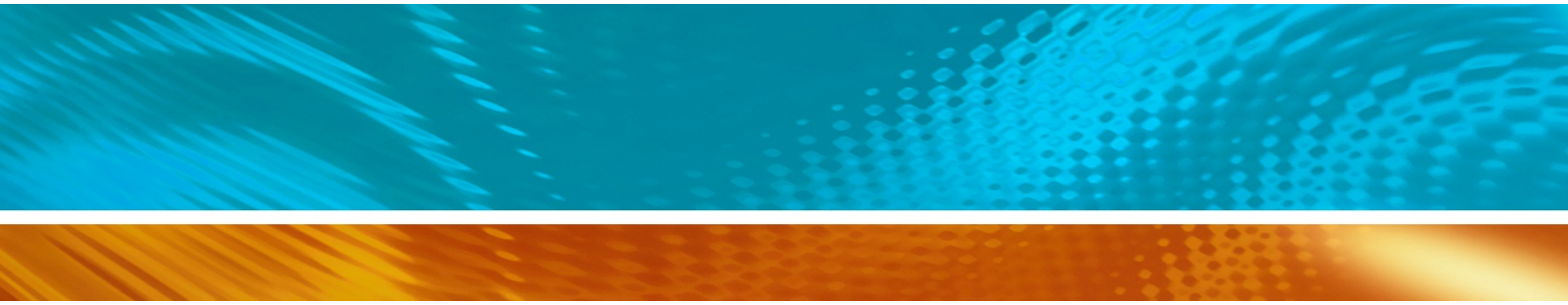


Figure 26 DMT143 Dimensions – Model With NPT Thread



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